

SEMIARID PRECIPITATION FREQUENCY PROJECT

Update of *Technical Paper No. 49* and *NOAA Atlas 2*

Thirtieth Progress Report
1 July 2004 through 30 September 2004

Hydrometeorological Design Studies Center
Hydrology Laboratory

Office of Hydrologic Development
U.S. National Weather Service
National Oceanic and Atmospheric Administration
Silver Spring, Maryland

October 2004

DISCLAIMER

The data and information presented in this report are provided only to demonstrate current progress on the various technical tasks associated with this project. Values presented herein are NOT intended for any other use beyond the scope of this progress report. Anyone using any data or information presented in this report for any purpose other than for what it was intended does so at their own risk.

TABLE OF CONTENTS

1. Introduction	1
2. Highlights	4
3. Progress in this Reporting Period	5
4. Issues	9
5. Projected Schedule and Remaining Tasks	9
References	10

SEMIARID PRECIPITATION FREQUENCY PROJECT

Update of *Technical Paper No. 49* and *NOAA Atlas 2*

1. Introduction

The Hydrometeorological Design Studies Center (HDSC), Hydrology Laboratory, Office of Hydrologic Development, U.S. National Weather Service has updated its precipitation frequency estimates for the Semiarid Southwestern United States. Updated precipitation frequency estimates contained in NOAA Atlas 14 Volume 1 "Precipitation Frequency Atlas of the United States" replace those found in *Technical Paper No. 49* "Two- to ten-day precipitation for return periods of 2 to 100 years in the contiguous United States" (Miller et al 1964), *NOAA Atlas 2* "Precipitation-Frequency Atlas of the Western United States" (Miller et al 1973), "Short Duration Rainfall Frequency Relations for California" (Frederick and Miller, 1979) and "Short Duration Rainfall Relations for the Western United States" (Arkell and Richards, 1986) for the Semiarid region. The project included data collection and quality control, dataset formatting, regional frequency analyses, frequency distribution selection and fitting techniques, spatial interpolation and documentation.

The project determined annual all-season precipitation frequencies for durations from 5 minutes to 60 days, for average recurrence intervals from 2 to 1,000 years. For the project, HDSC reviewed and processed all available rainfall data for the Semiarid project area and used accepted statistical methods. In particular, the Semiarid Project was the pilot project in which decisions regarding the methods and format were made that affect subsequent projects. Documentation and project results are published as Volumes of *NOAA Atlas 14* on the internet (<http://www.nws.noaa.gov/ohd/hdsc>) with the additional ability to download digital files.

NOAA Atlas 14 Volume 1 includes estimates for 4 states completely, Arizona, Nevada, New Mexico, and Utah, and southeastern California. Additional data from 7 bordering states and Mexico (Figure 1) were included for continuity across state borders. The core and border areas and regional groups used for long duration (24-hour through 60-day) analyses are shown in Figure 1. Regional groups used for short duration (60-minute through 12-hour) analyses are shown in Figure 2.

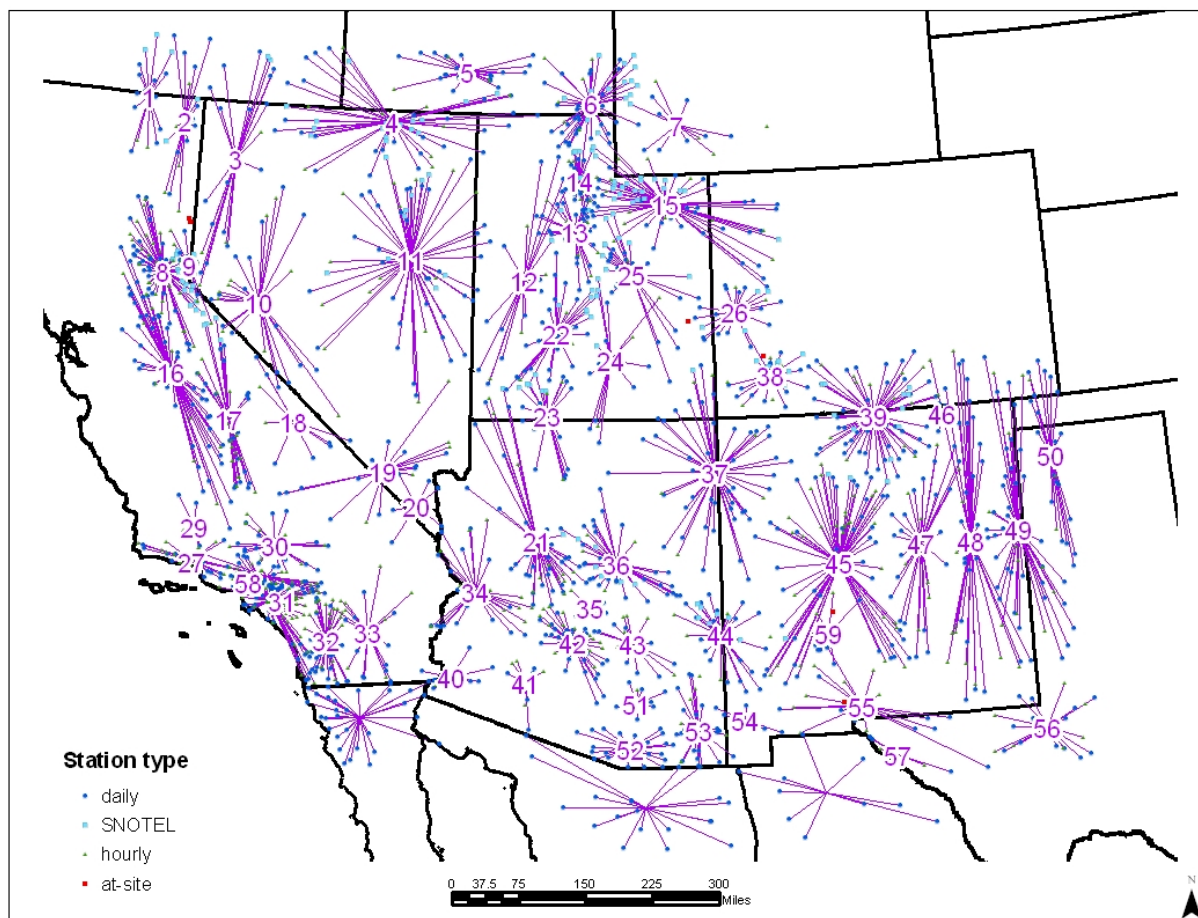


Figure 1. Semi-arid Precipitation Frequency project area and 59 regional groups for 24-hour and longer duration values.

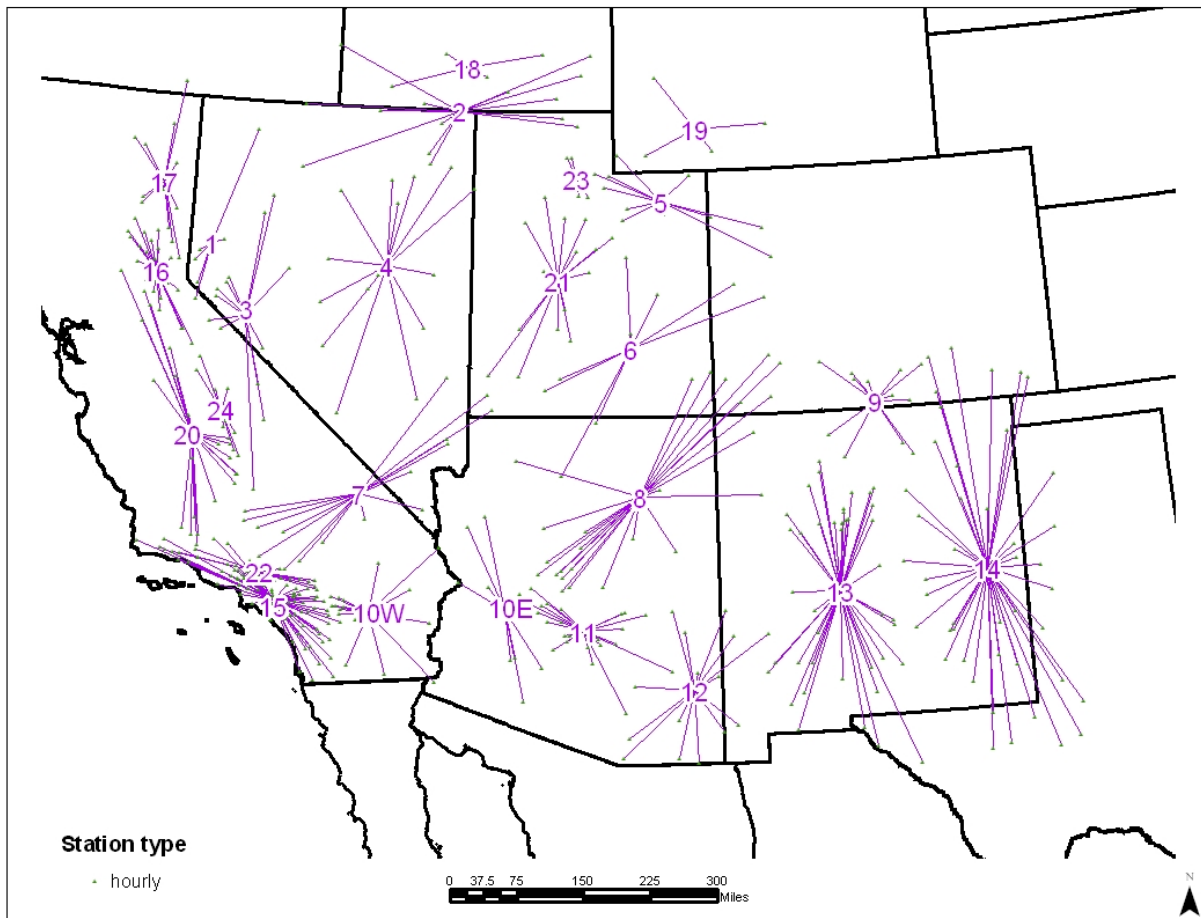


Figure 2. Semi-arid Precipitation Frequency 25 regional groups for 12-hour and shorter duration values.

2. Highlights

Documentation for NOAA Atlas 14 Volume 1 (Bonnin et al., 2004) for the precipitation frequency estimates of the Semiarid Southwestern United States is now available at <http://hdsc.nws.noaa.gov/hdsc/>. This documentation will be DRAFT until October 31st, 2004 to allow users the opportunity to review and provide comments back to HDSC. Additional information is provided in Section 3.1, Final Documentation.

The difference between 2 extraction procedures for the partial duration series (PDS) was examined. It was found that both procedures produced similar results. Additional information is provided in Section 3.2, PDS Extraction.

The Precipitation Frequency Data Server (PFDS) - the on-line portal for all NOAA Atlas 14 deliverables and information - underwent several subtle, but important changes. Additional information is provided in Section 3.3, Precipitation Frequency Data Server.

Progress continues in the development of geographically-fixed Areal-Reduction-Factor (ARF) curves for basin area sizes of 10 to 400 square miles. Development and testing of software is 90% complete. An additional study area (Santa Barbara County, CA) has been added and two other study areas (Ventura County, CA and Chickasha, OK) are being considered. There are currently 12 study areas located throughout the conterminous U.S., Hawaii, and Puerto Rico that have been quality controlled, processed and ready for ARF analysis. Additional information is provided in Section 3.4, Areal Reduction Factors.

3. Progress in this Reporting Period

3.1 Final Documentation

Documentation for NOAA Atlas 14 Volume 1 precipitation frequency estimates for the Semiarid Southwestern United States was published on September 27th, 2004. It is available at <http://hdsc.nws.noaa.gov/hdsc/>. This documentation will be DRAFT until October 31st, 2004 to allow users the opportunity to review and provide comments back to HDSC. The final documentation will be posted following a short revision period in November 2004.

The documentation includes descriptions of the quality control and analytical procedures, descriptions of the results and how to interpret them, and tables of statistical measures and regional growth factors. It also includes temporal distributions for heavy rainfall, seasonality and trend information.

3.2 PDS Extraction

A partial duration series (PDS) is constructed by taking all of the highest cases above a threshold regardless of the year in which the case occurred. For this project, PDS consisted of the N largest cases in the period of record, where N is the number of years in the period of record at the particular observing station. Such a series is also called an annual exceedance series (AES) (Chow et al., 1988). A new extraction procedure for an AES was compared to the current procedure (described below). The difference between the 2 extraction procedures was examined and it was found that both procedures produced similar results.

In the current extraction procedure (AES1), the maximum precipitation for each month was selected and then sorted in descending order for the 1-day and 2-day durations. For longer durations, a pre-defined number of cases were selected in each year and sorted. The highest N values were then extracted from these cases based on the number of actual years of record for that station. However, an alternative extraction procedure (AES2), considers an unlimited number of maxima from each year regardless of month or pre-defined number of cases in each year. The cases for consideration in this procedure were required to be separated by at least one dry day. A comparison showed that precipitation frequency estimates derived from each extraction procedure were not different. In fact, for the 1-day, 7-day and 30-day durations that were tested in all 59 regions in the project area, the AES2/AES1 ratio varied roughly between 0.988 and 1.015.

3.3 Precipitation Frequency Data Server

The Precipitation Frequency Data Server (PFDS) - the on-line portal for all NOAA Atlas 14 deliverables and information - underwent several subtle, but important changes. They include:

1. Several frequently asked questions were added to the FAQ page (http://hdsc.nws.noaa.gov/hdsc/pfds/pfds_faq.html)
2. The text on the Seasonality graph axis was changed to be consistent in terminology
3. Updated README file that resides in each of the state- and region-specific anonymous ftp directories
4. Redesigned version table on "GIS Data and Maps" page (http://hdsc.nws.noaa.gov/hdsc/pfds/pfds_data.html) making it clearer which version number is associated with which project
5. Updated NA14 documents web page with table and links to the various pdf files representing the difference sections of the draft NOAA Atlas 2 Volume 1 documentation
6. Added Time Series button to state-specific pages
7. Modified state-specific pages without updated data to include links to newly posted scanned documents available via the Current PF Publications page (<http://www.nws.noaa.gov/ohd/hdsc/currentpf.htm>)
8. 5-year and 10-year exceedances were added to the seasonality graphs

HDSC continuously monitors the hits, integrity and performance of the PFDS, which receives an increasing number of hits per month. The graph (Figure 3) below summarizes the number of individual data inquiries made since January 2004, while the map (Figure 4) indicates the locations of inquiries during the past quarter.

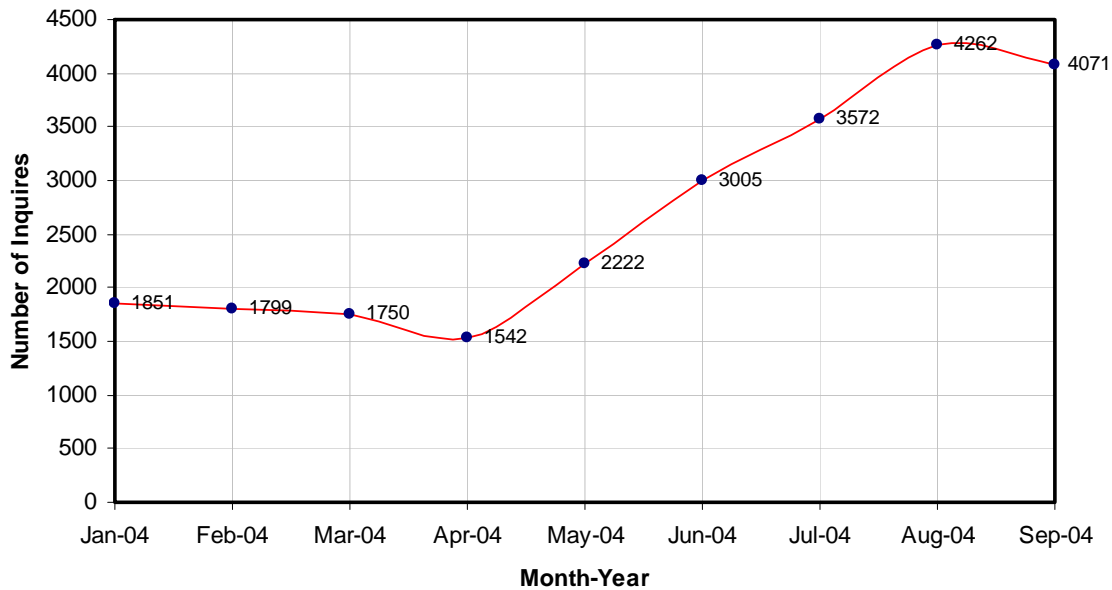


Figure 3: Number of individual PFDS data inquiries per month.

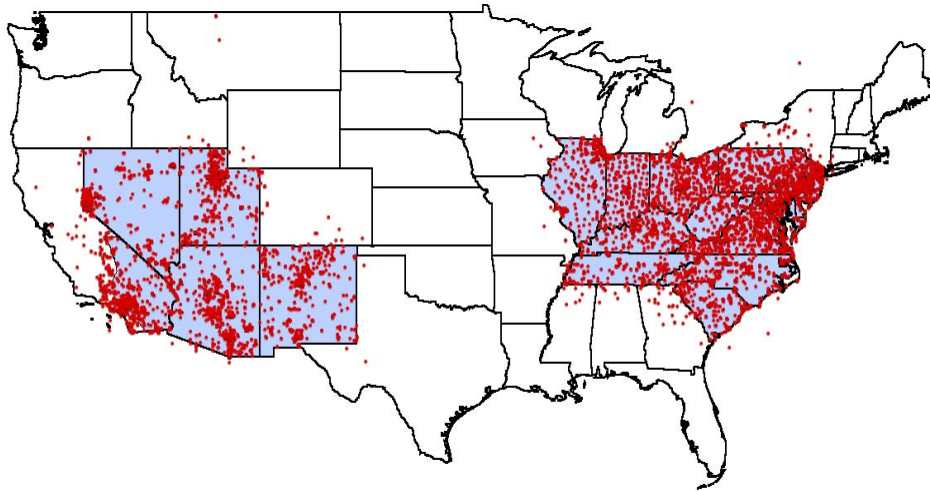


Figure 4: Map of 11,905 PFDS data inquiry locations during the period July-September 2004.

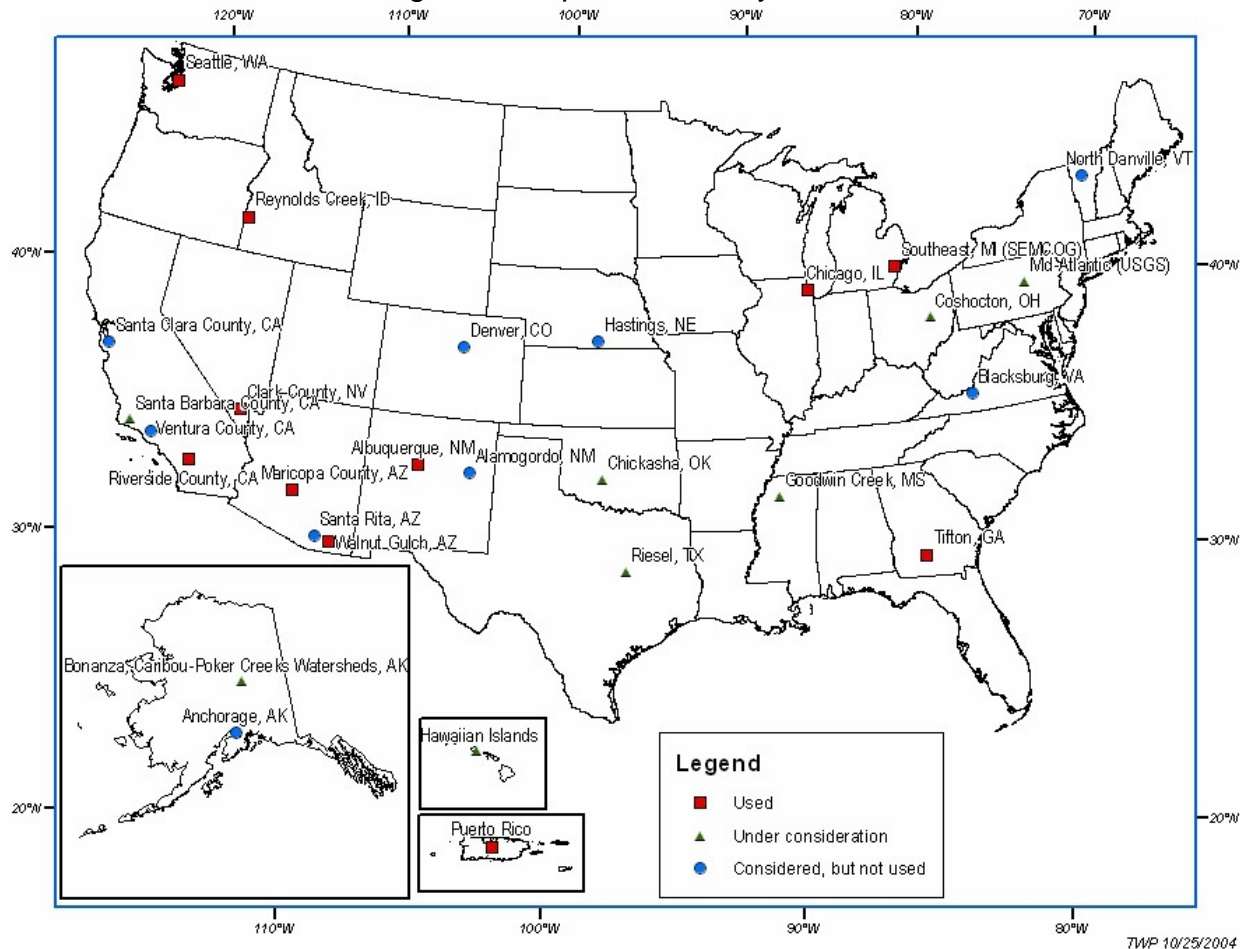
3.4 Areal Reduction Factors

Progress continues in the development of geographically-fixed Areal-Reduction-Factor (ARF) curves for basin area sizes of 10 to 400 square miles. Development and testing of software from the procedure described in NOAA Technical Report NWS 24 continues and is 90% completed.

An additional study area (Santa Barbara County, CA) has been added to the list of areas that could be used to develop the final set of ARF curves. Quality control is being performed and will be completed shortly on the precipitation data from this site. Two other study areas (Ventura County, CA and Chickasha, OK) are also being considered. The Blacksburg, VA study area has been eliminated as one of the sites to be analyzed because it lacks sufficient station density.

There are currently 12 study areas located throughout the conterminous U.S., Hawaii, and Puerto Rico that have been quality controlled, processed and ready for ARF analysis (see Figure 5). The “not used” study areas indicated in Figure 5 were considered but judged inadequate for the study due to poor data, limited or no metadata, or other problems. The set of ARF curves developed for each study area used will be tested for differences to determine if a single set of ARF curves can be used for the entire U.S. as is the case today or whether separate curves for different regions of the country are more appropriate.

Figure 5: Map of ARF study areas



4. Issues

4.1 Recent and Upcoming Presentations

Past and future presentations by HDSC, include the following:

- “Recent Updates to NOAA/NWS Rainfall Frequency Atlases” at the California Extreme Precipitation Symposium in Davis, CA on July 1, 2004
- An update of the Ohio River Basin and Surrounding States Precipitation Frequency Project progress at the 84th Meeting of the Ohio River Basin Commission on July 14, 2004
- “Recent Updates to NOAA/NWS Rainfall Frequency Atlases” at the Colorado Association of Stormwater and Floodplain Managers (CASFM) Annual Conference in Glenwood Springs, Colorado on September 23-24, 2004

5. Projected Schedule and Remaining Tasks

The following list provides a tentative schedule with completion dates. Brief descriptions of tasks being worked on next quarter are also included in this section.

Areal Reduction Factors [January 2005]

5.1 Documentation

Draft documentation may be revised based on any comments received by users by October 31st, 2004. The final documentation will be published in November 2004.

5.2 Areal Reduction Factors (ARF)

Computations for the ARF curves will be completed in the next quarter for 12 areas. The resulting curves will be tested for differences to determine if a single set of ARF curves is applicable to the entire U.S. or whether curves vary by region.

References

- Arkell, R.E., and F. Richards, 1986: Short duration rainfall relations for the western United States, Conference on Climate and Water Management-A Critical Era and Conference on the Human Consequences of 1985's Climate, August 4-7, 1986. Asheville, NC.
- Bonnin, G., D. Todd, T. Parzybok, B. Lin, D. Riley, and M. Yekta, 2004: Precipitation frequency atlas of the United States. NOAA Atlas 14 Volume 1, Silver Spring, Maryland. <http://hdsc.nws.noaa.gov/hdsc/>.
- Chow, V.T., D.R. Maidment, and L.W. Mays, 1988: Applied Hydrology. McGraw-Hill International Editions, 572 pp.
- Frederick, R.H. and J.F. Miller, 1979: Short Duration Rainfall Frequency Relations for California, Third Conference on Hydrometeorology, August 20-24, 1979. Bogata Columbia.
- Frederick, R.H., V.A. Myers and E.P. Auciello, 1977: Five- to 60-minute precipitation frequency for the eastern and central United States, NOAA Technical Memo. NWS HYDRO-35, Silver Spring, MD, 36 pp.
- Hershfield, D.M., 1961: Rainfall frequency atlas of the United States for durations from 30 minutes to 24 hours and return periods from 1 to 100 years, *Weather Bureau Technical Paper No. 40*, U.S. Weather Bureau. Washington, D.C., 115 pp.
- Hosking, J.R.M. and J.R. Wallis, 1997: *Regional frequency analysis, an approach based on L-moments*, Cambridge University Press, 224 pp.
- Huff, F. A., 1990: Time Distributions of Heavy Rainstorms in Illinois, *Illinois State Water Survey*, Champaign, 173, 17pp.
- Institution of Engineers, Australia, 1987: *Australian Rainfall and Runoff, 3rd Edition*, The Institution of Engineers, Australia. Canberra.
- Lin, B. and L.T. Julian, 2001: Trend and shift statistics on annual maximum precipitation in the Ohio River Basin over the last century. Symposium on Precipitation Extremes: Prediction, Impacts, and Responses, 81st AMS annual meeting. Albuquerque, New Mexico.
- Miller, J.F., 1964: Two- to ten-day precipitation for return periods of 2 to 100 years in the contiguous United States, *Technical Paper No. 49*, U.S. Weather Bureau and U.S. Department of Agriculture, 29 pp.

- Miller, J.F., R.H. Frederick and R.J. Tracy, 1973: Precipitation-frequency atlas of the western United States, *NOAA Atlas 2*, 11 vols., National Weather Service, Silver Spring, MD.
- Myers, V.A. and R.M. Zehr, 1980: A Methodology for Point-to-Area Rainfall Frequency Ratios, NOAA Technical Report NWS 24, Office of Hydrology, National Weather Service, Silver Spring, MD.